

WHAT IS CLAIMED IS:

1. A method for manufacturing gas sensor elements each having i) a cylindrical and substantially  
5 tumbler-shaped solid-electrolyte body which has a closed-end head portion and, on the side opposite to the head portion, an open-ended base tail portion, ii) an electrode provided on the surface of the solid-electrolyte body and iii) a porous protective layer  
10 which covers the surface of the electrode; the method comprising:

forming the electrode on an electrode-forming surface of the solid-electrolyte body;

subsequently measuring a radius  $R$  of the  
15 solid-electrolyte body, at a radius measurement position  $A$  of a protective-layer-forming surface of the solid-electrolyte body;

spraying a molten protective-layer material on the protective-layer-forming surface by means of a plasma  
20 thermal-spraying equipment to form the protective layer;

measuring a radius  $S$  of the solid-electrolyte body inclusive of the protective layer, at a point  $B$  of intersection of a normal at the radius measurement position  $A$  with the surface of the protective layer; and  
25 controlling the amount of spray of the

protective-layer material in the plasma thermal-spraying equipment, regarding a difference between the radius S and the radius R as the thickness of the protective layer and on the basis of this thickness, to form each  
5 protective layer in a desired thickness.

2. The manufacturing method according to claim 1, wherein said gas sensor elements are continuously manufactured in a large number, and the amount of spray  
10 of said protective-layer material is increased or decreased making reference to the thickness of each protective layer at the part between the radius measurement position A and the intersection point B in respect of a gas sensor element manufactured directly  
15 previously.

3. The manufacturing method according to claim 2, wherein said radius measurement position A and said intersection point B are selected at random from those of  
20 a large number of solid-electrolyte bodies.

4. The manufacturing method according to claim 3, wherein said radius measurement position A is selected for each solid-electrolyte body in such a way that a  
25 distance from the top of the head portion of each

solid-electrolyte body to an intersection point of the axis of each solid-electrolyte body with the normal at the radius measurement position A comes equal to one another.

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5. A method for manufacturing gas sensor elements each having i) a cylindrical and substantially tumbler-shaped solid-electrolyte body which has a closed-end head portion and, on the side opposite to the head portion, an open-ended base tail portion, ii) an electrode provided on the surface of the solid-electrolyte body and iii) a porous protective layer which covers the surface of the electrode; the method comprising:

15 forming the electrode on an electrode-forming surface of the solid-electrolyte body;

subsequently measuring radii  $T_1, T_2 \dots$  of the solid-electrolyte body at a plurality of radius measurement positions  $D_1, D_2 \dots$  selected along a peripheral circle C on a protective-layer-forming surface of the solid-electrolyte body while rotating the solid-electrolyte body around its axis extending along the axial direction connecting the base tail portion and the head portion;

25 spraying a molten protective-layer material on the

protective-layer-forming surface by means of a plasma thermal-spraying equipment to form the protective layer;

measuring radii  $U_1, U_2 \dots$  of the solid-electrolyte body inclusive of the protective layer, at points  $E_1, E_2 \dots$  of intersection of normals at the radius measurement positions  $D_1, D_2 \dots$  with the surface of the protective layer; and

controlling the amount of spray of the protective-layer material in the plasma thermal-spraying equipment, regarding an average of differences between the radii  $T_1, T_2 \dots$  at the respective radius measurement positions and the radii  $U_1, U_2 \dots$  at the respective intersection points corresponding to the former as the thickness of the protective layer and on the basis of this thickness, to form each protective layer in a desired thickness.

6. The manufacturing method according to claim 5, wherein said gas sensor elements are continuously manufactured in a large number, and the amount of spray of said protective-layer material is increased or decreased making reference to the thickness of a protective layer formed directly previously.

7. The manufacturing method according to claim 5,

wherein;

said radius measurement positions D1,D2 . . . are  
allocated at intervals of 1° at maximum up to D180 at  
maximum on each solid-electrolyte body, and radii T1,T2 .  
5 . . up to T180 at maximum are measured at the respective  
radius measurement positions; and

said radius measurement positions E1,E2 . . . are  
allocated at intervals of 1° at maximum up to E180 at  
maximum on each solid-electrolyte body, and radii U1,U2 .  
10 . . up to U180 at maximum are measured at the respective  
radius measurement positions.